

An aerial photograph of a lake with a dirt road running through its center. The lake is surrounded by dense green forest. The water on the left is a murky, greenish-grey color, while the water on the right is a deep blue. There are some small boats in the greenish water on the left. A small dock or pier is visible on the right side of the dirt road. The text "Early Warnings of Harmful Algal Blooms in Lakes" is overlaid in a large, bold, black font on a semi-transparent white background.

# Early Warnings of Harmful Algal Blooms in Lakes

**Grace Wilkinson**  
Iowa State University



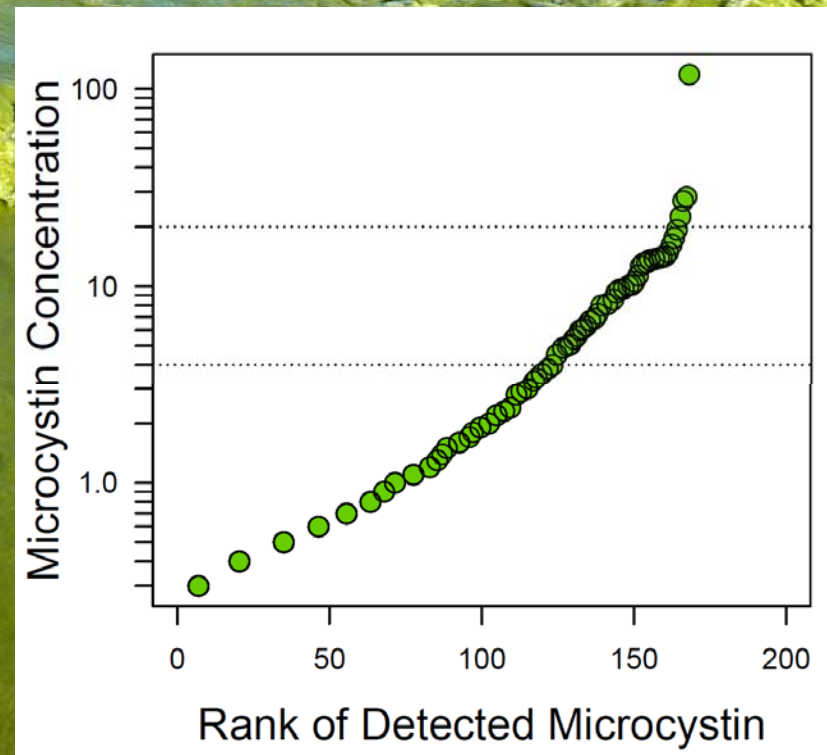


- Harmful algal booms in Iowa lakes
- Are there early warnings of HABs in lakes?
- Putting early warnings into practice in Iowa

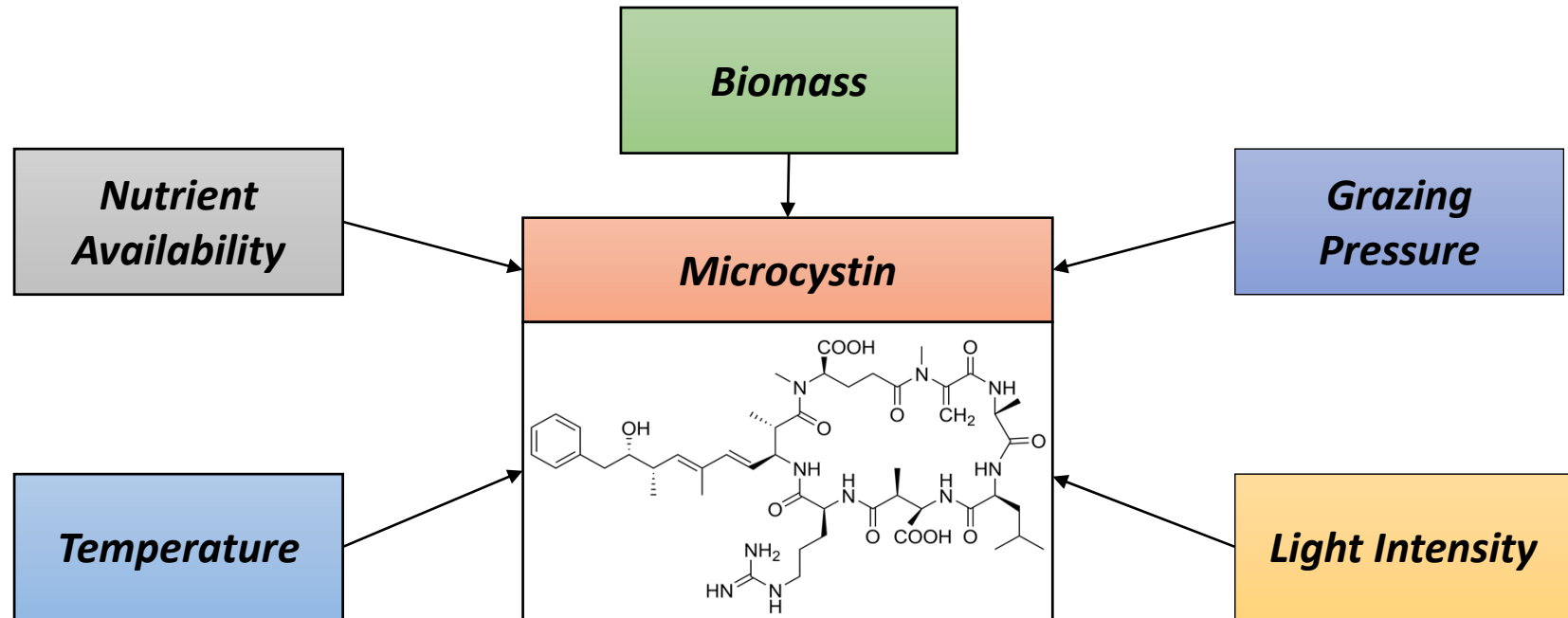


**In 2017, three out of four Iowa lakes are considered eutrophic or hypereutrophic**

- *Anoxic bottom waters*
- *Algal scums*
- *Taste and odor issues*
- *Fish kills possible*
- *Cyanobacteria & cyanotoxin risk*



# What controls cyanotoxin production?



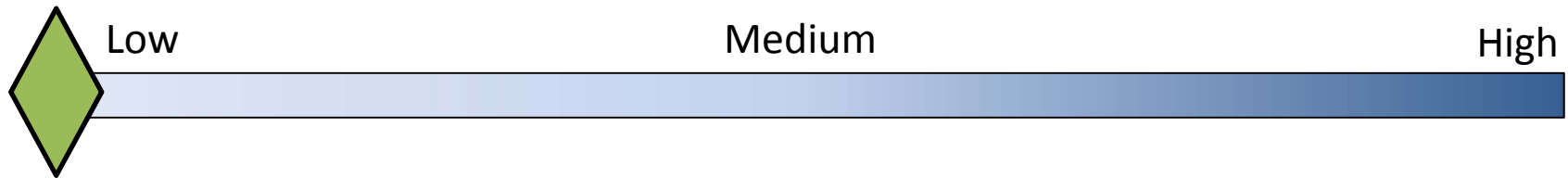
*Combining genetic techniques with microcystin assays and environmental data to address this question in Iowa lakes*



Can cyanobacteria  
blooms be predicted in  
order to prevent  
exposure risk?



# Nutrient Loading

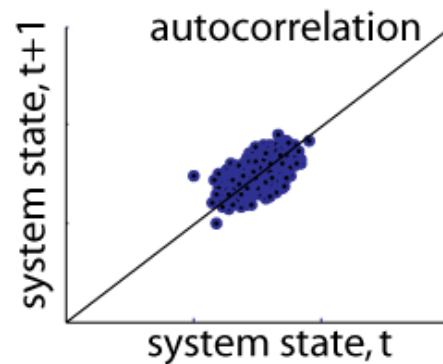
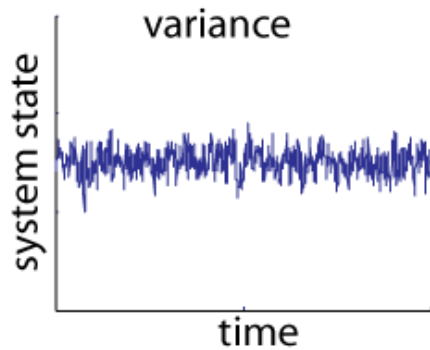
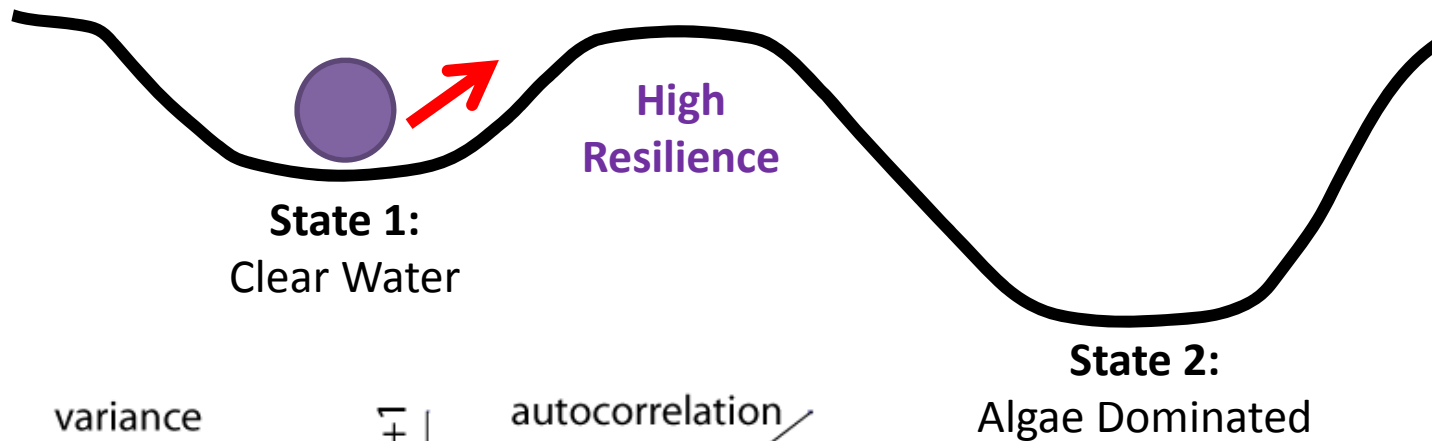
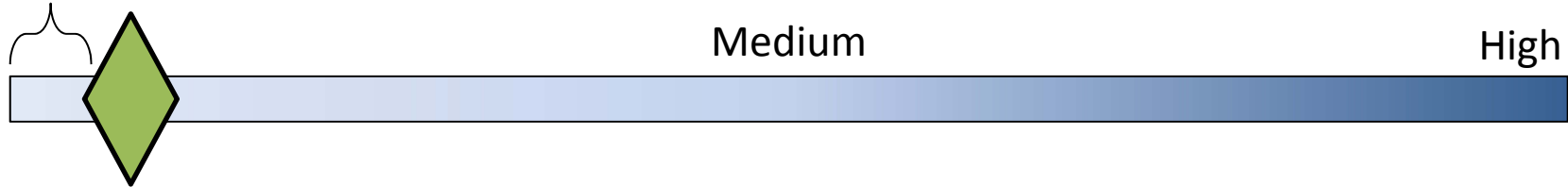


**State 2:**  
Algae Dominated



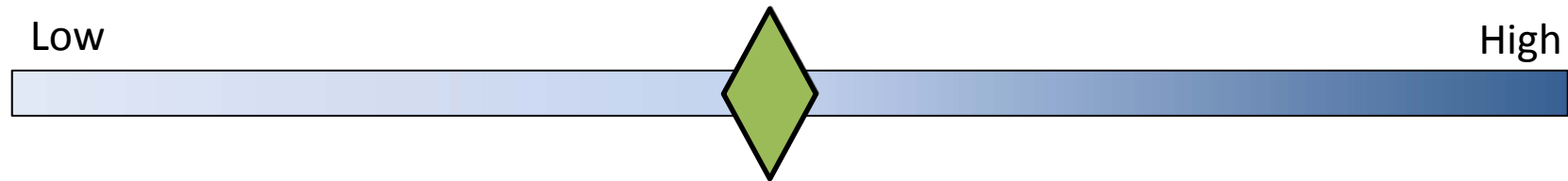
# Nutrient Loading

Small Perturbation



**AC:** how much does today look like yesterday?

# Nutrient Loading



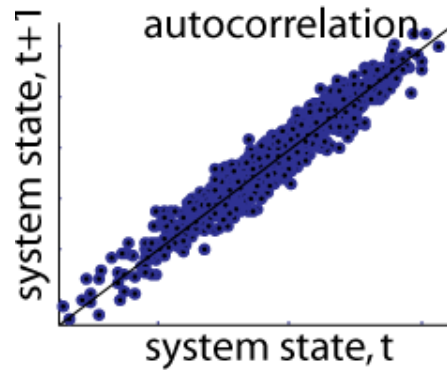
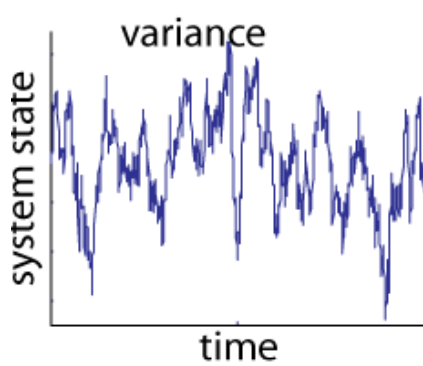
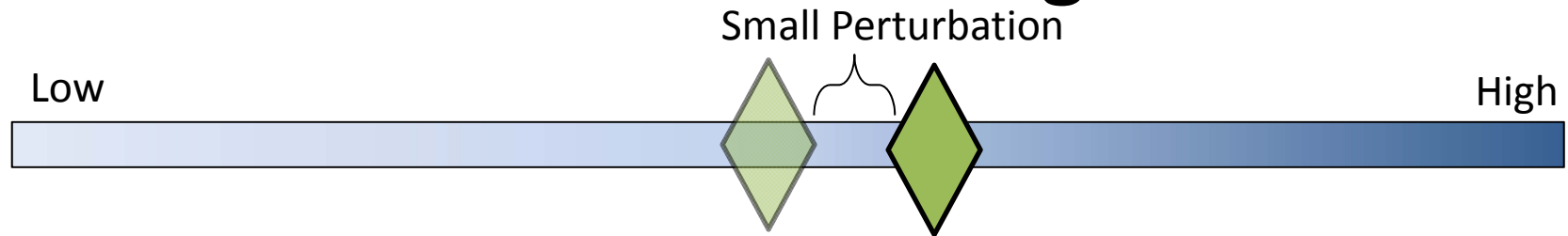
**State 1:**  
Clear Water



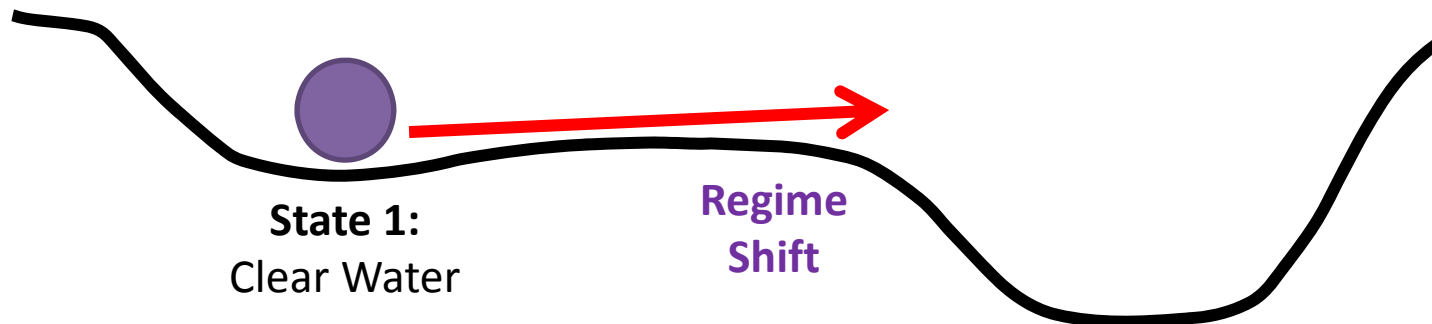
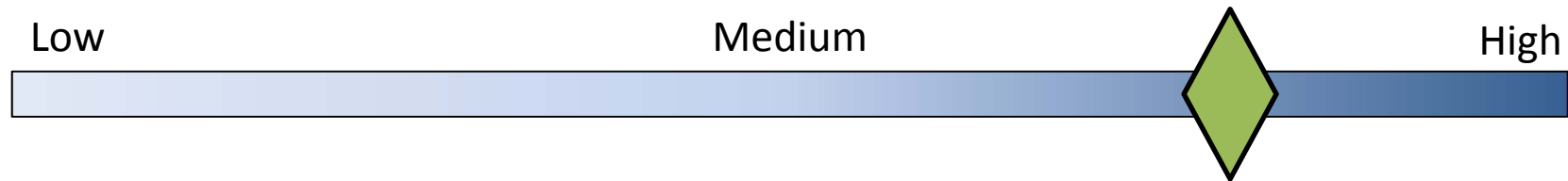
**State 2:**  
Algae Dominated



# Nutrient Loading



# Nutrient Loading

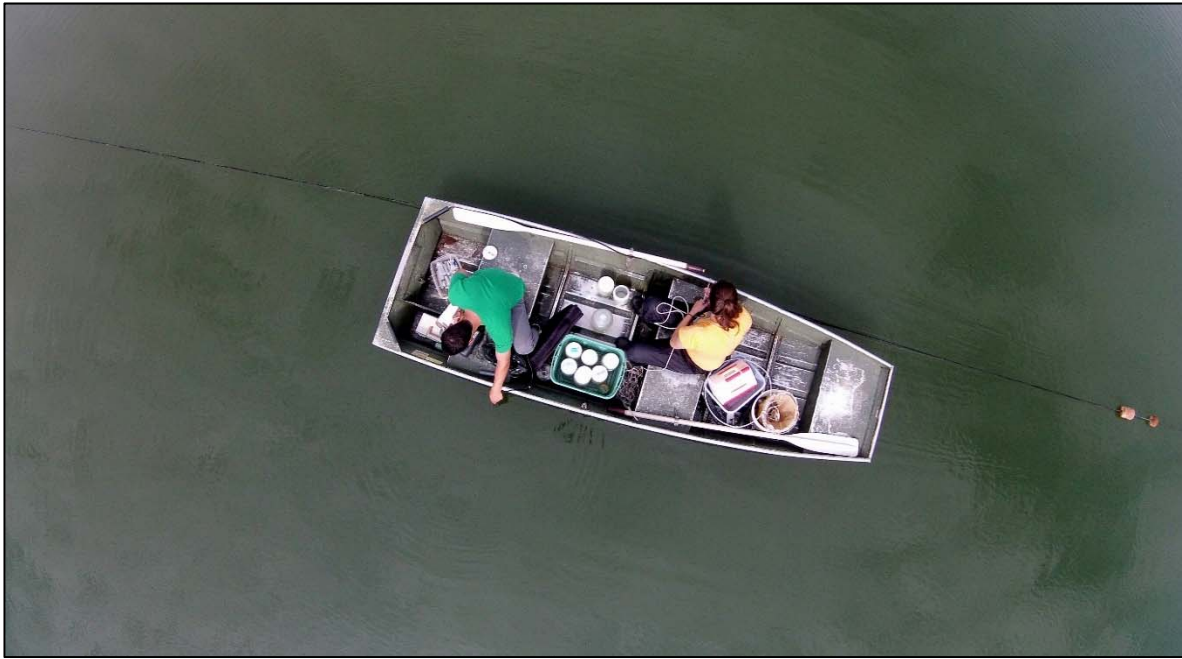




Are there early  
warnings of  
harmful algal  
blooms?



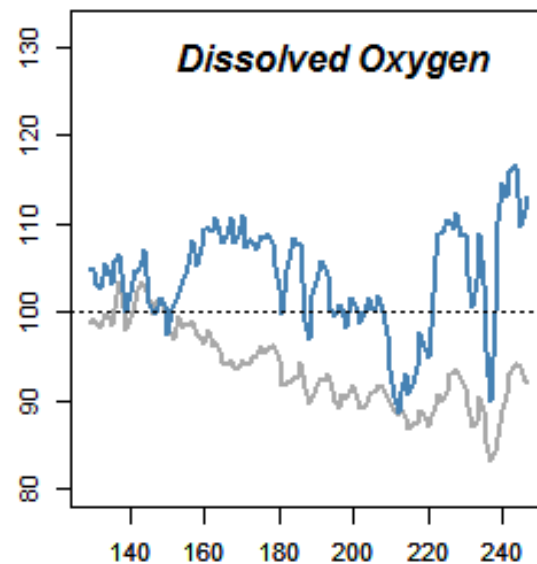
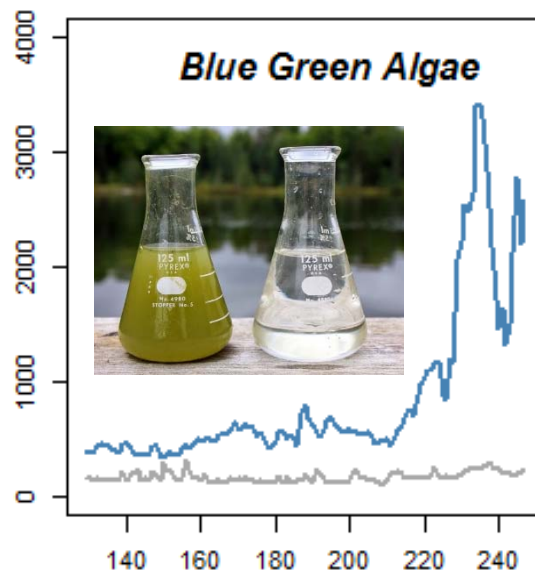
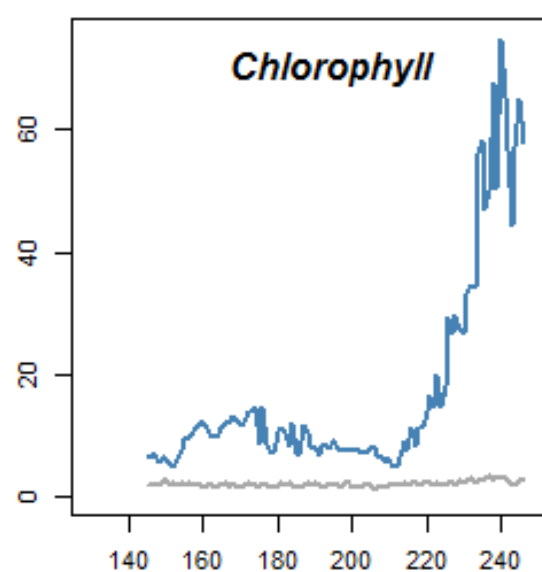




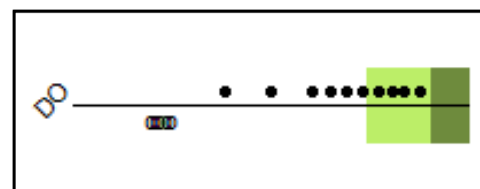
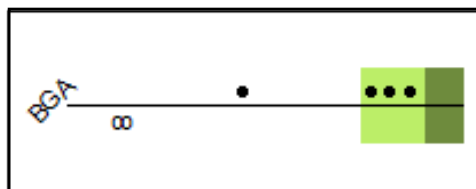
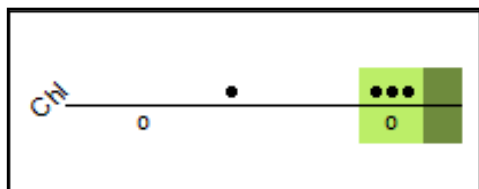




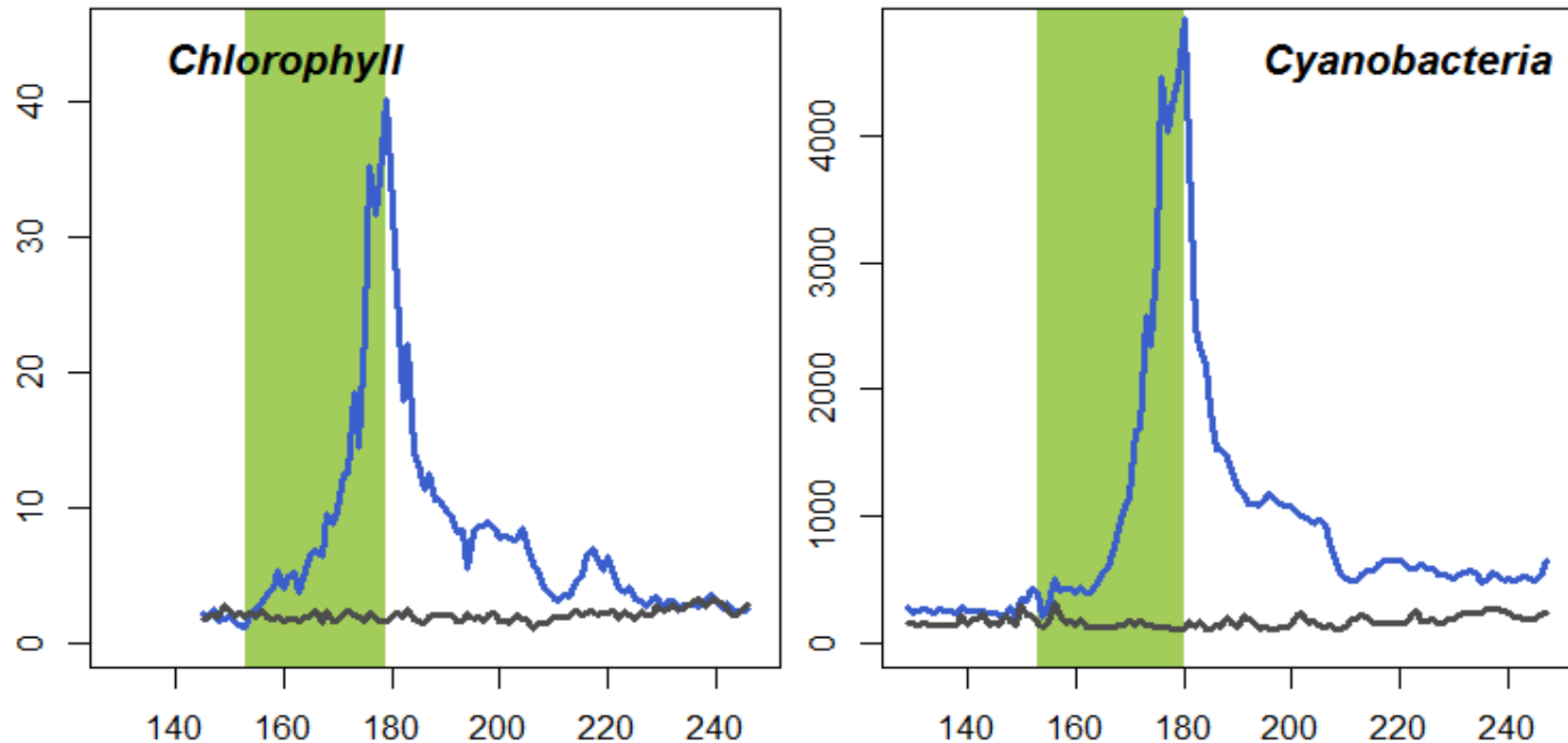
**Ecosystem Alarms**



**Alarms**



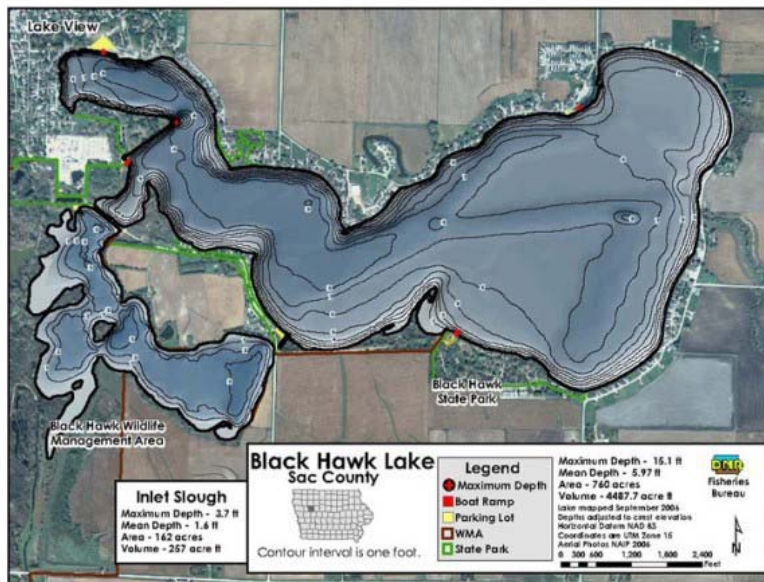
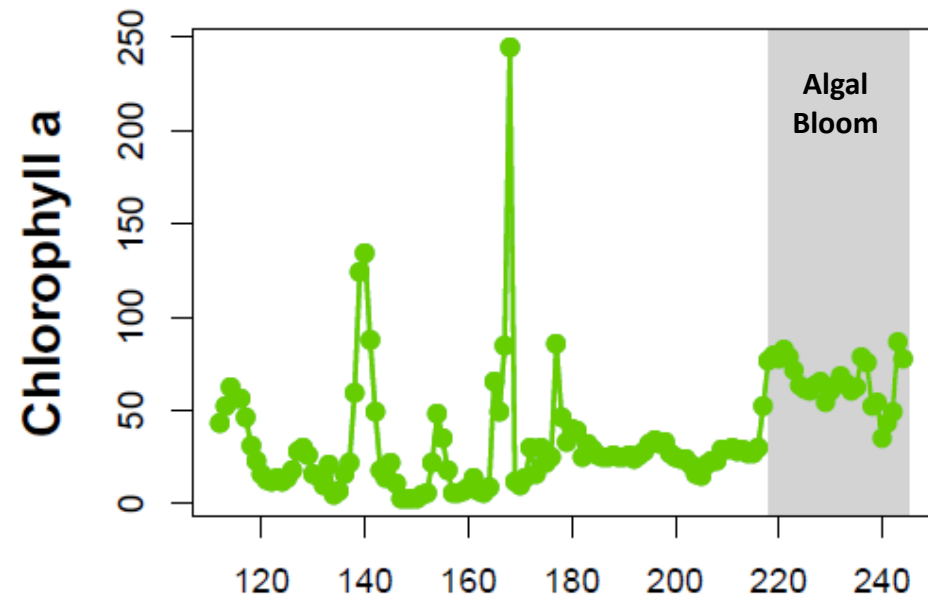
# Can early warnings be used to prevent sustained HABs?



- *Acted on the early warning alarms and intervened*
- *The lake recovered and did not stay in the bloom state*

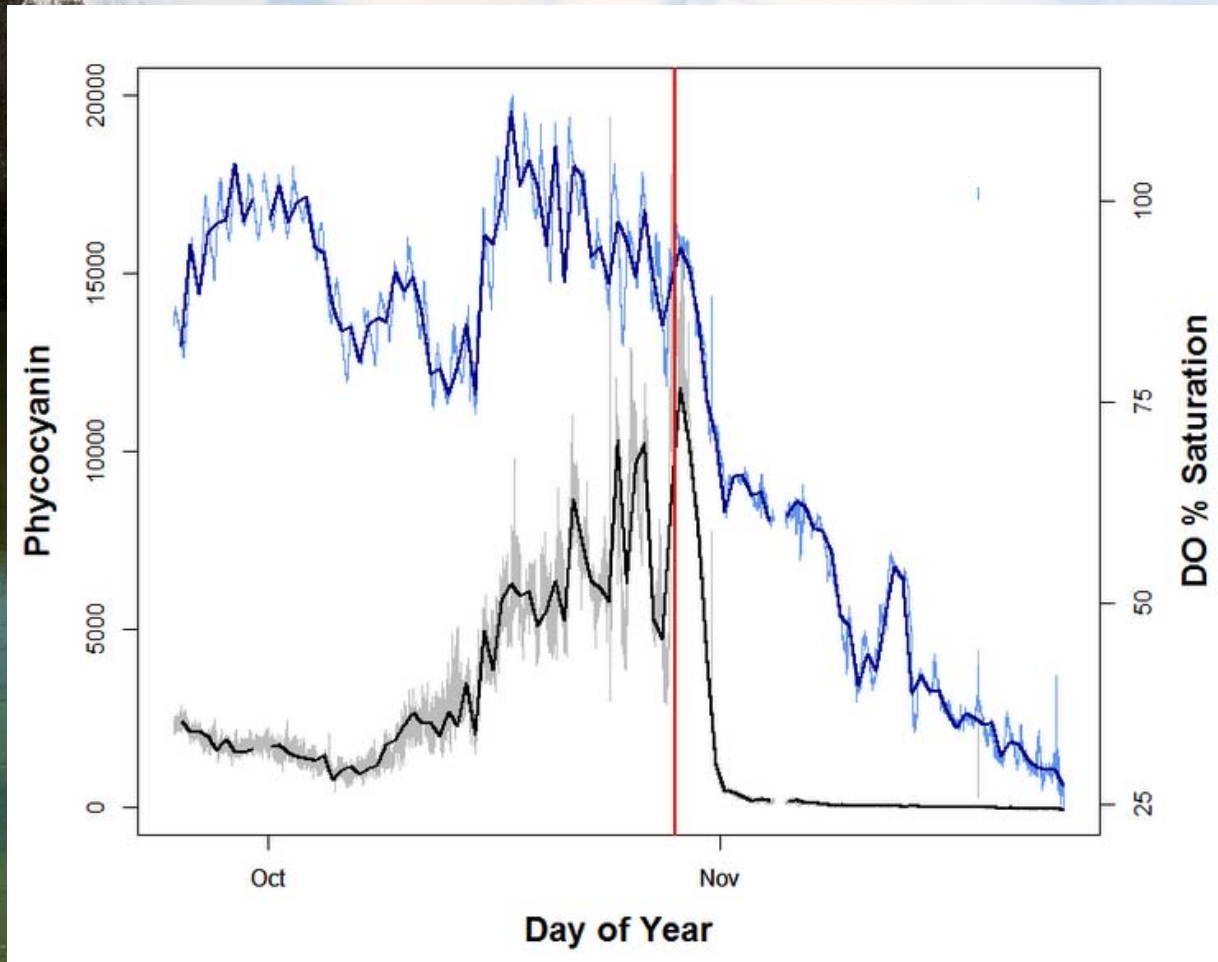


# Are early warnings of HABs detectable in Iowa Lakes?



Data courtesy of Jason Palmer, Iowa DNR

# Reactive vs. Proactive Management





# A Tool for Proactive Management



*Herbicide application with minimal ecological and service impact*




*Beach closures to minimize toxin exposure risk*



*Photo: Ben Wallace*

*Aeration and mixing systems to prevent fish kills*



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- Blooms are becoming more frequent and are dominated by cyanobacteria
  - There are statistical early warnings before blooms
  - Putting early warnings into practice in Iowa



A bluegill fish is shown swimming in a pond. The fish is positioned in the upper left quadrant of the frame, facing towards the left. It has a blueish-green body with a prominent blue ring around its eye. The background is filled with numerous green lily pads and their stems, creating a dense, textured environment. The water appears clear and bright, suggesting a sunny day.

# Questions?

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